

Stratigraphic Forward Modelling through the Surat Basin: Testing Controls on the Basal Unconformity of the Springbok Fm (Late Oxfordian)

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Abstract

Interest in basin fill mechanisms for the Surat Basin has grown in response to its emergence as a gas resource. After a long history of conventional gas exploration, the eastern Surat Basin has developed as an active regional exploration target for Coal Seam Gas, hosting large gas reserves (Scott et al., 2007; Hamilton et al., 2013). The Surat Basin is characterised by sedimentary successions with high level of geometric complexity. The difficulty in correlating coal seams and groups from the eastern to the western flanks of the Surat Basin increases the uncertainty for a complete depositional model, which provides compulsory information on reservoir architectures.

The technology of Stratigraphic Forward Modelling (SFM) has advanced to the stage where numerical simulation of the depositional processes can be used to predict conventional reservoir properties at appropriate scales, away from wells and below seismic resolution. Such advanced approach now empowers geologists with a way to validate a conceptual sedimentological model and assess the concurrent action of imposed forcings on sedimentary systems.

LECODE (Landscape Evolution Climate Ocean and Dynamic Earth) is a new geomorphic and stratigraphic forward modelling code capable of simulating surface evolution and clastic sedimentary processes in 3D through geological times (Salles & Duclaux, 2014). This numerical tool can be used to test geological scenarios and to assess and compare existing geological data to simulated one, such as high-resolution stratigraphic record, sediment dispersion and clastic sedimentary system evolution (Bianchi et al., submitted).

This work focuses on a stratigraphic forward model of the Springbok Formation, deposited during the early Late Jurassic (Oxfordian) within the Surat Basin. This formation is ascribed by the literature to an extensive fluvio-alluvial system, which is conformably overlaid to the alluvio-coastal system of Westbourne Fm (Kimmeridgian-Tithonian).

The key-feature of the Springbok Fm is the basal unconformity, which in places incises the Walloon Coal Measures on the eastern margin of the basin. The stratigraphical relationship between Walloon and Springbok in the western and the central part of the basin is not well documented (Hoffmann et al., 2009). Investigating the nature of the unconformity can be useful for the prediction of reservoir connectivity. Several hypotheses are correlated to the Springbok Fm unconformity, involving climatic changes and tectonics. Nonetheless, the Argoland rifting occurring in that timing and the consequent thermal uplift seems have a strong importance.